Chapter Three
FACILITY REQUIREMENTS

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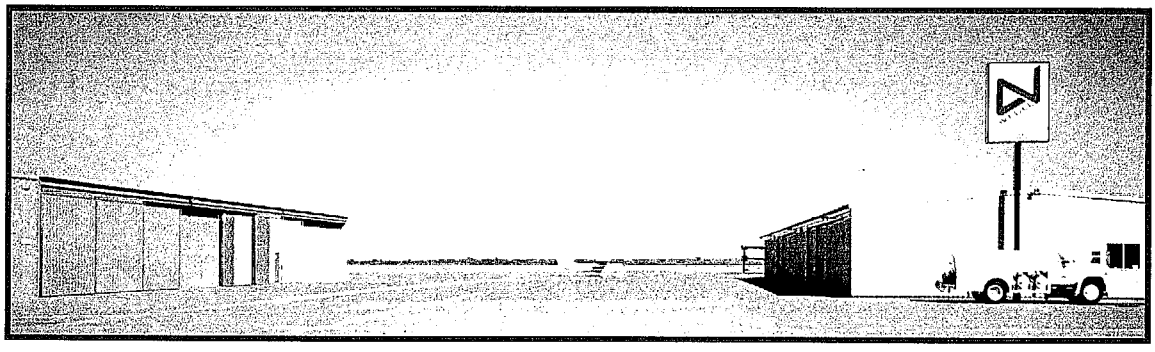


To properly plan for the future of Avra Valley Airport, it is necessary to translate forecasted aviation use into the specific types and quantities of facilities that can adequately serve this identified demand. This chapter uses the results of the forecasting conducted in Chapter Two and establishes planning criteria to determine the airfield (i.e., runways, taxiways, navigational aids, marking and lighting) and landside (i.e., hangars, terminal building, aircraft parking apron, fueling, automobile parking and access) facility requirements.

The objective of this effort is to identify, in general terms, the adequacy of the existing airport facilities and to outline what new facilities may be needed, and when they may be needed to accommodate forecasted demands. Having established these requirements, alternatives for providing the necessary facilities will be evaluated in Chapter Four to determine the most cost-effective and efficient means for implementation.

Recognizing that the need to develop facilities is determined by demand, rather than a point in time, the requirements for new facilities have been expressed for the short, intermediate, and long term planning horizons, which roughly correlates to five-year, ten-year, and twenty- year time frames. Future facility needs will be related to these activity levels rather than a specific year. **Table 3A** summarizes the activity levels that define the planning horizons used in the remainder of this master plan.

TABLE 3A
Planning Horizon Activity Levels

	Short Term Planning Horizon	Intermediate Term Planning Horizon	Long Term Planning Horizon
Based Aircraft	290	341	440
Annual Operations	97,000	115,000	150,000

AIRFIELD REQUIREMENTS

Airfield requirements include the needs for those facilities related to the arrival and departure of aircraft. These facilities comprise the following items:

- Runways
- Taxiways
- Navigational Aids
- Airfield Marking and Lighting

The following describes the scope of facilities that would be necessary to accommodate the airport's forecasted role throughout the planning period.

AIRFIELD DESIGN STANDARDS

The selection of the appropriate FAA design standards for the development of the airfield facilities is based primarily upon the characteristics of the aircraft that are expected to use the airport. The most critical characteristics are the **approach speed** and **wingspan** of the **critical design aircraft** anticipated to use the airport both now and in the future. The critical design aircraft is defined as the most demanding category of aircraft that conducts 500 or more operations per year. Planning for future aircraft use is of particular importance since design standards are used to plan separation distances between facilities. Appropriately locating these airfield facilities now reduces/eliminates the need to relocate them in the future, which would be an expensive endeavor.

The FAA has established criteria for use in the sizing and design of airfield facilities. These standards include criteria which relate to aircraft size and performance. According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design,* an aircraft's approach category is based upon 1.3 times its stall speed in landing configuration at the aircraft's maximum certificated weight. The five approach categories used in airport planning are as follows:

Category A: Speeds of less than 91 knots.

Category B: Speeds of 91 knots or more, but less than 121 knots.

Category C: Speeds of 121 knots or more, but less than 141 knots.

Category D: Speeds of 141 knots or more, but less than 166 knots.

Category E: Speeds of 166 knots or more.

The second basic design criteria relates to aircraft size. The Airplane Design Group **(ADG)** is based upon wingspan. The six groups are as follows:

Group I: Up to but not including 49 feet.

Group II: 49 feet up to but not including 79 feet.

Group III: 79 feet up to but not including 118 feet.

Group IV: 118 feet up to but not including 171 feet.

Group V: 171 feet up to but not including 214 feet.

Group VI: 214 feet or greater.

Together, approach category and ADG identify a coding system whereby airport design criteria are related to the operational and physical characteristics of the aircraft

intended to operate at the airport. This code, the **Airport Reference Code** (ARC), has two components: the first, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed (operational characteristic); the second, depicted by a Roman numeral, is the airplane design group and relates to aircraft wingspan (physical characteristic). Generally, aircraft approach speed applies to runways and runway-related facilities, while airplane wingspan primarily relates to separation criteria involving taxiways and taxilanes. **Table 3B** provides a listing of typical aircraft including their Airport Reference Code, approach speed, wingspan, and maximum takeoff weight.

The FAA advises designing airfield elements to meet the requirements of the airport's most demanding or critical aircraft. As previously discussed, this is the aircraft or group of aircraft expected to perform 500 or more operations per year. In order to determine facility requirements, the ARC of the airport should first be determined, then appropriate airport design criteria can be applied.

All types of general aviation aircraft from single-engine piston to business jets utilize Avra Valley Airport. Presently, however, turboprop and business jet activity is somewhat limited with single engine aircraft comprising 78 percent of the current based aircraft as well as accounting for the majority of operations. In the future, increased turboprop and business jet use can be expected at the airport.

Currently, business jets weighing up to 30,000 pounds are the most likely class of business jets to operate at Avra Valley Airport. This class commonly includes the Cessna Citation, Dassault Falcon, and Lear Jet series of aircraft. These aircraft comprise the majority of active business jet aircraft and are the most cost-effective for corporations to own and operate. The Cessna Citations and Dassault Falcon fall within ARC B-II while Lear Jets are classified within ARC's C-I and D-I.

Currently, ARC C-II design standards apply to Avra Valley Airport and will continue to govern future facility requirements throughout the planning horizon. These standards apply to larger jets than those mentioned above (e.g., Gulfstream III), and, therefore, should insure safe and adequate future facilities design from both the landside and airside perspective.

RUNWAYS

The adequacy of the existing runway system has been analyzed from a number of perspectives such as runway length, runway width, and pavement strength. From this information, requirements for runway improvements have been determined for the airport.

Airfield Capacity

A demand/capacity analysis measures the capacity of the airfield facilities (i.e., runways and taxiways) in order to identify a plan for additional development needs. The capacity of the airfield is affected by several factors including airfield layout, meteorological conditions, aircraft mix, runway use, aircraft arrivals, aircraft touch-and-go activity, and exit taxiway locations. An airport's airfield capacity is expressed in terms of its annual service volume. Annual service volume is a reasonable estimate of the maximum level of aircraft operations that can be accommodated in a year with limited levels of delay.

TABLE 3B
Representative General Aviation Aircraft by Airport Reference Code

Airport Reference Code	Typical Aircraft	Approach Speed (knots)	Wingspan (feet)	Maximum Takeoff Weight (lbs.)
	Single-Engine Piston			
A-I	Cessna 150	55	32.7	1,600
A-I	Cessna 172	64	35.8	2,300
A-I	Beechcraft Bonanza	75	37.8	3,850
	Multi-Engine Piston			
B-I	Beechcraft Baron 58	96	37.8	5,500
B-I	Piper Navajo	100	40.7	6,200
B-I	Cessna 421	96	41.7	7,450
	Turboprop			
B-I	Mitsubishi MU-2	119	39.2	10,800
B-I	Piper Cheyenne	119	47.7	12,050
B-I	Beechcraft King Air B-100	111	45.8	11,800
	Business Jets			
B-I	Cessna Citation I	108	47.1	11,850
B-I	Falcon 10	104	42.9	18,740
	Turboprop			
B-II	Beechcraft Super King Air	103	54.5	12,500
B-II	Cessna 441	100	49.3	9,925
	Business Jets			
B-II	Cessna Citation II	108	51.7	13,330
B-II	Cessna Citation III	114	53.5	22,000
B-II	Falcon 20	107	53.5	28,660
B-II	Falcon 900	100	63.4	45,500
	Business Jets			
C-I	Learjet 55	128	43.7	21,500
C-I	Rockwell Sabre 75A	137	44.5	23,300
C-I	Learjet 25	137	35.6	15,000
	Turboprop			
C-II	Rockwell 980	121	52.1	10,325
	Business Jets			
C-II	Canadair Challenger	125	61.8	41,250
C-II	Gulfstream III	136	77.8	69,700
	Business Jets			
D-I	Learjet 35	143	39.5	18,300
D-II	Gulfstream II	141	68.8	65,300
D-II	Gulfstream IV	145	78.8	71,780

According to FAA guidelines detailed in FAA Advisory Circular 150/5060-5 *Airport Capacity and Delay*, the annual service volume (ASV) of a two runway, crosswind configuration comparable to Avra Valley Airport normally exceeds 230,000 operations. Estimated annual operations for the Airport in 1997 were 71,300. FAA criteria recommend the consideration of a parallel runway when forecast annual operations exceed 60 percent of an airport's ASV. The operational forecasts for Avra Valley Airport, as shown on **Table 3A**, indicate that the forecasts for the long term planning horizon will be 150,000 annual operations or slightly more than 65 percent of the ASV. Based on these projections, long term planning should include the consideration of a parallel runway to the existing Runway 12-30. This parallel runway will both increase the airport's operational capacity and reduce aircraft delays.

Runway Orientation

Wind conditions are a prime element in determining runway orientation. When prevailing winds are consistently from one direction, runways are generally oriented in that direction. In most areas, however, consistency of wind direction is not found. In these circumstances, a multiple runway configuration may be required. The FAA has established guidelines recommending that an airport's runway system should provide 95 percent usability of the airfield. This 95 percent wind coverage is based upon the crosswind not exceeding 10.5 knots (12 mph) for ARC's A-I and B-I; 13 knots (15 mph) for ARC's A-II and B-II; and 16 knots (18 mph) for ARC's C-I through D-II.

Avra Valley Airport is currently served by two runways, Runway 12-30 is the primary runway and is oriented in a northwest-southeast direction, while the crosswind runway, Runway 3-21 is situated northeast by southwest. An examination of Exhibit 1F, Wind Rose in Chapter One, illustrates the continued necessity of an operational crosswind runway at the airport. Though neither runway, alone, meets the minimum requirements for wind coverage in the 10.5 knot (12 mph) range their combined coverage is more than adequate to satisfy the above guidelines. Both runways exceed the 95 percent required coverage for the 13 knot (15 mph) and 16 knot (18 mph) categories. Again, the recommended parallel runway would be oriented in the same northwest-southeast direction as the existing Runway 12-30.

Runway Length

The determination of runway length requirements for an airport are based upon five primary factors: airport elevation; mean maximum temperature of the hottest month; runway gradient (elevation differences between each runway end); critical aircraft type expected to use the airport, and stage length of the longest nonstop trip destinations. Aircraft performance declines as elevation, temperature, and runway gradient factors increase.

An analysis of the current and future fleet mix indicates that business jets will be the most demanding aircraft with regard to runway length at Avra Valley Airport. The type of business aircraft expected to use the airport in the future range from the Cessna Citation I, which has minimal runway length requirements, to the larger, more powerful Gulfstream III's, which require longer runway lengths. **Table 3C** summarizes the runway

length requirements for the varied classes of aircraft which are expected to utilize the airport. These requirements were derived from the FAA Airport Design computer program (Version 4.2D). As with other design criteria, runway length requirements are based upon the critical aircraft grouping.

Based upon both the existing and projected aircraft fleet mix, Runway 12-30's current ARC C-II design standards will continue to direct this runway's future requirements. The applicable FAA runway length design category for ARC C-II aircraft is "Large airplanes of 60,000 pounds or less". Runway 12-30's current length of 6,901 feet exceeds the requirements (5,500 feet) for "75 percent of these planes at 60 percent useful load" within this category as shown in **Table 3C**. However, it is recommended that if possible, Runway 12-30 be extended 299 feet to 7,200 feet which would allow it to accommodate "100 percent of these planes at 60 percent useful load".

TABLE 3C
Runway Length Requirements

Airport elevation	2,031 feet
Mean daily maximum temperature of the hottest month	102.8 F
Maximum difference in runway centerline elevation	21 feet
RUNWAY LENGTHS RECOMMENDED FOR AIRPORT DESIGN	
Small airplanes with approach speeds of less than 30 knots	360 feet
Small airplanes with approach speeds of less than 50 knots	960 feet
Small airplanes with less than 10 passenger seats	
75 percent of these small planes	3,360 feet
95 percent of these small planes	4,040 feet
100 percent of these small planes	**4,690 feet**
Small airplanes with 10 or more passenger seats	4,890 feet
Large airplanes of 60,000 pounds or less	
75 percent of these planes at 60 percent useful load	5,500 feet
100 percent of these planes at 60 percent useful load	**7,190 feet**

Source: FAA Airport Design computer program Version 4.2A.

Runway 3-21 is currently designed to ARC B-I standards. The present runway length of 4,201 feet is more than adequate for this design category. Currently, Runway 3 has a displaced threshold of 260 feet, which is located approximately 390 feet northeast of the northern edge of Avra Valley Road. The Avra Valley Airport Layout Plan (ALP) Update, completed in 1997, proposed upgrading this runway to ARC B-II standards. Extending the runway 499 feet to 4,700 feet was recommended. This proposed length meets the requirements for 100 percent of the aircraft in the "Small airplanes with less than 10 passengers seats" category. Chapter Four, Development Alternatives, will examine alternative designs relating to relocating Runway 3's displaced threshold to a safer distance from Avra Valley Road as well as increasing the total runway length of Runway

3-21 to 4700 feet, allowing it to accommodate ARC B-II aircraft weighing in excess of 12,500 pounds.

It is recommended that the future parallel runway proposed in the previous section be designed to ARC B-II specifications. As with Runway 3-21, a length of 4,700 feet will allow this new runway to accommodate 100 percent of the aircraft in the "Small airplanes with less than 10 passengers seats" category.

Runway Width

Presently, Runway 12-30 is 100 feet wide. This width meets the requirements for C-II aircraft. The existing width of 75 feet for Runway 3-21 meets both ARC B-I and B-II design standards. Neither of these runways will require future widening. The required width of the proposed future parallel runway is 75 feet.

Runway Strength

Both of the existing runways at Avra Valley Airport have a published pavement strength rating of 12,500 pounds single-wheel gear loading (SWL). This rating has proved insufficient for some of the larger types of aircraft using the airport over the past several years. An inadequate runway strength can result in damage to the paved runway surface and/or the aircraft landing gear assembly. The design aircraft for ARC C-II, the Gulfstream III, has a maximum takeoff weight of 69,700 pounds. Also, with the expected increase in corporate aircraft activity at the airport, Runway 12-30 pavement strength should be upgraded to 75,000 pounds dual-wheel gear loading (DWL). Marana Skydiving, which conducts contract training with several different military groups throughout the year, is host to C-130 aircraft that average between 100 and 200 operations annually. The maximum takeoff weight of the C-130 (155,000 pounds) is considerably more than the C-II design aircraft (Gulfstream III), however, the limited number of average annual operations does not justify increasing the pavement strength rating of either the runways or taxiways beyond the 75,000 pounds DWL recommended above.

While the 12,500 pound SWL strength rating for Runway 3-21 is sufficient for the short-term planning horizon, eventually this runway should be upgraded to 30,000 dual-wheel gear loading (DWL) to allow it to accommodate the smaller type of corporate aircraft that may utilize it in the future. Furthermore, the future parallel runway should be constructed to 30,000 DWL.

TAXIWAYS

Taxiways are constructed primarily to facilitate aircraft movements to and from the runway system. Some taxiways are necessary simply to provide access between the aprons and runways, whereas other taxiways become necessary as activity increases at an airport in order to provide safe and efficient use of the airfield. Three crucial elements involved in taxiway design are: taxiway width, separation distance between runways and parallel taxiways, and pavement strength rating.

Exhibit 1B, in Chapter One illustrates the existing taxiway system at Avra Valley Airport. Runway 12-30 is served by Taxiway A, a full length, 35-foot wide, parallel taxiway. The centerline-to-centerline separation distance between Runway 12-30 and Taxiway A is 400 feet. The ARC C-II requirement is 300 feet separation between runway centerline and parallel taxiway centerline. Taxiway A intersects Taxiway B which is a 35-foot wide, partial length, parallel taxiway that serves Runway 3-21. The centerline-to-centerline separation distance between Taxiway B and Runway 3-21 is 240 feet, which exceeds the 225-foot separation requirement of ARC B-I (current design standard) and equals the 240-foot requirement for runway category ARC B-II (future design standard). While Taxiway A provides terminal area and apron access, Taxiway B is the main access to the T-hangar, tie-down, and terminal areas. Another taxiway, Taxiway C, connects Taxiway A to Runway 3-21, Taxiway B, and the terminal area. Taxiway C is 40-feet wide and is the main access for the FBO's located adjacent to it. Taxiway A3, also 40-feet wide, connects Runway 12-30 to Taxiway B and the terminal area. An additional system of stub taxiways connects the parallel taxiways to their related runways as well as the terminal area. The width of these stub taxiways varies from 35 to 40 feet. A taxiway widening and lighting project for Taxiways A, A-1, A-3, A-4, and Taxiway B which was slated for Spring 1998 had not yet been implemented at the time this chapter was prepared. Currently, however, all of the existing taxiways at Avra Valley Airport meet the minimum width requirements for the ARC C-II standards which are in affect now and throughout the projected planning period of the airport. Future extensions to both Runway 12-30 and Runway 3-21 will require extending the associated parallel Taxiways A and B respectively, as well as additional exit taxiway stubs. Options concerning high speed taxiway exits and taxiway intersection widening as it relates to Runway 12-30 will be explored in the next chapter which deals with various airport development alternatives.

In conjunction with a future parallel runway, a related full-length parallel taxiway and its connecting stubs should be constructed. Like the proposed runway, this taxiway system must meet ARC B-II design criteria with regard to width and runway-taxiway separation distance. These requirements specify a width of 35 feet and runway-taxiway separation of 240 feet.

Additionally, it is recommended that holding aprons be provided at or near each runway end. These aprons provide aircraft with an area to make final checks prior to takeoff. Aircraft unable to takeoff due to a malfunction can be bypassed here by other aircraft ready for takeoff. Generally, such aprons are designed large enough to accommodate from two to four aircraft, which is dependent on the average size of aircraft utilizing the runway in question.

Presently, there are certain sections of taxiway, taxilane locations, and apron areas whose close proximity to fixed structures limits the access of certain business jets to the terminal area and other facilities. Again, Chapter Four will address various options that improve or correct these limitations affecting business jet activity at the airport.

As with the runways, the current pavement strength ratings for all taxiways at Avra Valley Airport is 12,500 pounds SWL. To meet ARC C-II standards, the taxiways expected to handle the larger, business jet class of aircraft should be strengthened to 75,000 pounds

DWL. This would include all of Taxiway A plus its respective stubs, and Taxiway C.

Those taxiways that service only aircraft utilizing Runway 3-21 would retain their 12,500 SWL rating for the short-term planning period. Upon Runway 3-21's upgrade to 30,000 DWL, all related taxiways should be upgraded accordingly. Also, any new taxiways constructed to serve the proposed parallel runway shall be designed to 30,000 DWL.

NAVIGATIONAL AIDS

Electronic navigational aids are used by aircraft during an approach to an airport. Instrument approach procedures are a series of maneuvers designed by the FAA which utilize navigational aids to aid pilots in locating and landing at an airport and are especially helpful during inclement weather conditions. Additionally, pilots often use instrument approaches during good visibility conditions. At present, there are no instrument approaches available at Avra Valley Airport. There is a non-directional beacon (NDB) located at the airport, which was commissioned in June 1999. Prior to the NDB commissioning, the airport was effectively closed during poor weather situations when visual flight could no longer be attempted.

Nationwide, the increased use of general aviation aircraft for business and corporate aircraft has elevated the need for instrument approaches at non-commercial airports. In order for the Avra Valley Airport to support the continued business and industrial growth expected in the surrounding communities, it is vital that the airport be accessible in all weather conditions and that any weather-related down time at the airport be reduced. The advent of Global Positioning System (GPS) technology will ultimately provide the capability of establishing instrument approaches at the airport. As noted in Chapter One, the FAA has begun a program to transition from existing ground-based navigational aids to a satellite-based navigation system utilizing GPS technology. Currently, GPS is certified for enroute guidance and for use with instrument approach procedures. The initial GPS approaches being developed by the FAA provide only course guidance information. In the near future, it is expected that GPS will also be certified for use in providing descent information for an instrument approach. This capability is currently only available using an Instrument Landing System (ILS).

At the time of this report, Avra Valley Airport had submitted Airport Eligibility Forms to the FAA with regard to the establishment of a GPS approach to Runway 12. Currently, the application is in the FAA review process. It should further be noted that a NAVAIDS study currently being completed by the Aeronautics Division of ADOT recommends and supports the establishment of a one-half mile visibility minimum GPS approach to this runway. ADOT's study notes that instituting such an approach is dependent upon the establishment of a Wide Area Augmentation System (WAAS). Facility planning, therefore, will proceed under the assumption that the GPS approach to Runway 12 will be approved and implemented within the short term planning horizon. Additionally, future planning should include GPS approaches to all remaining runway ends by the conclusion of the planning period. GPS approaches don not not require the installation of any ground facilities, and can, therefore be implemented at no cost to the Airport. The establishment of these approaches will require airspace

coordination with the FAA.

GPS approaches fit into three categories, each based upon the desired visibility minimum of the approach. The three categories of GPS approaches are: one-half mile, three-quarter mile, and one mile. To be eligible for a GPS approach, the airport landing surfaces must meet specific standards as outlined in Appendix 16 of the FAA Airport Design Circular. The specific airport landing surface requirements which must be met in order to establish a GPS approach and a comparison of these standards to existing airport facilities is summarized in **Table 3D**.

TABLE 3D
GPS Instrument Approach Requirements

Requirement	One-Half Mile Visibility	3/4-Mile Visibility Greater Than 300-Foot Cloud Ceiling	One-Mile Visibility Greater Than 400-Foot Cloud Ceiling	Existing
Minimum Runway Length	4,200 Feet	3,500 Feet	2,400 Feet	4,201 feet (3-21) 6,901 feet (12-30)
Runway Markings	Precision	Nonprecision	Visual	Visual (3-21) Visual (12-30)
Runway Edge Lighting	Medium Intensity	Medium Intensity	Low Intensity	Medium Intensity (Both)
Approach Lighting	MALSR	ODALS Recommended	Not Required	None
Primary Surface	500 feet clearance on each side of runway	500 feet clearance on each side of runway	250 feet clearance on each side of runway	125 feet (3-21)/ 250 feet (12-30) clearance on each side of runways

Source: Appendix 16, FAA AC 150/5300-13, Airport Design, Change 5
MALSR - Medium intensity Approach Lighting System with Runway Alignment Lighting
ODALS - Omni-directional Approach Lighting System

As evidenced by the table, the existing Runway 12-30 can currently support a GPS approach with three-quarter mile visibility minimums. A lower GPS approach minimum (one-half mile visibility), would require that the airport invest in additional approach lighting systems.

According to **Table 3D**, GPS approaches with less than one-mile visibility minimums require a greater separation of airfield and landside elements. By FAA standards, one-half mile and three-quarter mile visibility minimums require a cleared primary surface measuring 500 feet on either side of the runway centerline. This would not affect Runway 12-30, but if applied to Runway 3-21 would require removal or relocation of a conventional hangar near the Runway 3 end as well one T-hangar unit, a T-shade facility and several tie-downs located east of Taxiway B and north of the terminal area. GPS

approaches with visibility lower than one-mile could not be implemented to Runway 3-21 without removing or relocating these facilities. Therefore, it is advised that Runway 12 be planned for the ADOT recommended one-half mile visibility minimum GPS approach while all other runway ends, both existing and proposed, should be planned for one-mile visibility minimum GPS approaches. It should be noted that a one-half mile GPS approach to Runway 12 necessitates changes or additions to runway marking and lighting as well asrequiring land acquisition to facilitate required approach lighting installation and larger runway protection zones (RPZ).

LIGHTING AND MARKING

Currently, there are a number of lighting and pavement marking aids serving pilots and aircraft using Avra Valley Airport. These lighting and marking aids assist pilots in locating the airport at night and in poor weather conditions as well as facilitate aircraft movement on the ground. The current and future lighting requirements for the airport are summarized below.

Identification Lighting

The airport is equipped with a rotating beacon which assists pilots in locating the airport at night and four lighted wind cones near each runway end which provides pilots with information concerning wind conditions. Additionally, there is segmented circle with a lighted wind cone located just west of the intersection of the runways. The segmented circle indicates airport landing and takeoff traffic patterns to pilots using Avra Valley Airport. It is recommended that the segmented circle/lighted wind cone be maintained. The existing rotating beacon is adequate and should be maintained in the future. Meanwhile, airport users and tenants have expressed a need for additional lighted wind indicating devices, the type of which and their preferred locations will be addressed in the following Alternatives chapter.

Airfield Lighting

Runway 12-30 is equipped with medium intensity runway lighting (MIRL) as well as runway end identification lights (REIL) and runway threshold lighting. Meanwhile, Runway 3-21's lighting consists of MIRLs and runway threshold lighting only. As discussed in Chapter 1, MIRL's are runway edge lights while REIL's provide quick and positive identification of the approach end of the runway, whereas runway threshold lights delineate the runway's threshold location. It is recommended that the existing lighting systems for these two runways be maintained in the future, augmented by REILs which are to be installed at each end of Runway 3-21. Airfield lighting requirements for the future parallel runway would be the same as those for Runway 3-21.

Presently, there is no taxiway lighting available at Avra Valley Airport. However, the previously mentioned taxiway widening and lighting project does specify the installation of medium intensity taxiway lighting (MITL) for Taxiway A, it's related stub taxiways and Taxiway B. To further enhance the safety and efficiency of aircraft operations at night, facility planning should include the installation of pavement edge lighting along all the remaining taxiways, both existing and future, expected to handle ground traffic at night. Additionally, the installation of apron and aircraft parking area lighting

where not currently available would further enhance night operations and improve security.

Approach Lighting

Approach lighting systems aid the pilot in transition from instrument flight to visual flight for landing. As shown in **Table 3D**, a GPS approach of one-half mile visibility minimums to Runway 12 will require the installation of a medium intensity approach lighting system with runway alignment lighting (MALSR). For a three-quarter mile visibility minimum GPS approach an omnidirectional approach lighting system is recommended but not required. One mile approach visibility minimum GPS approaches require no approach lighting. The installation of the MALSR lighting system would require the acquisition of additional property beyond the end of Runway 12.

Visual Approach Aids

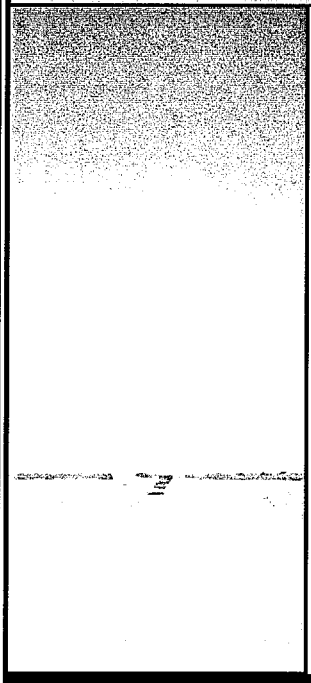
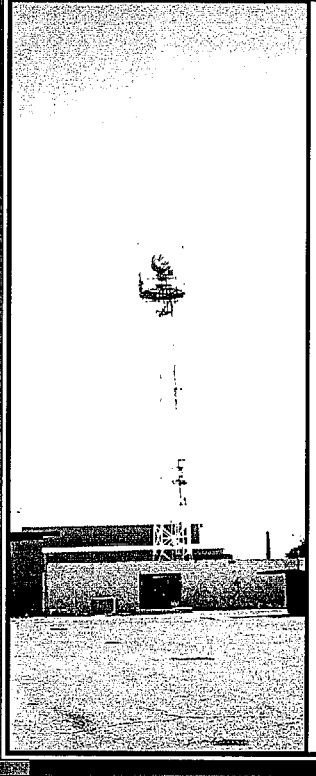
Visual glide slope indicators (VGSI) are a system of lights located at the side of the runway which provide visual descent guidance information to pilots during an approach to the runway. Runway 12-30 is equipped with a type of VSGI known as a precision approach path indicator or PAPI. The existing PAPI-4 system installed near each end of Runway 12-30 is adequate and should be maintained in the future. Runway 3-21 is equipped with another type of VGSI called a visual approach slope indicator (VASI). VASI's are considered to be somewhat antiquated equipment and which the FAA recommends replacing with the newer, more accurate PAPI or precision approach path indicator system. Therefore, the existing VASI-2 system installed near each end of Runway 3-21 should be replaced with PAPI-2s. Additionally, the future parallel runway should be planned with PAPI-2's.

Pavement Markings

The visual markings on Runway 3-21, and Runway 12-30 identify runway centerline and runway designation. Runway 3 has additional markings that indicate a displaced threshold and extend from the actual runway pavement end to where the 260-foot displaced threshold is located. The current visual markings on Runway 3-21 are sufficient for the future and should be maintained. For a future one-half mile visibility minimum GPS approach to Runway 12, precision markings will be required. Future one-mile visibility minimum GPS approaches to the remaining runway ends, both existing and future, require visual markings. The taxiways at the Airport are all marked with centerline striping, and certain taxiways are also denoted with edge marking as well. Any future taxiway construction at the Airport should include both centerline and edge markings.

Conclusions

Exhibit 3A presents a summary of airfield facility requirements for Avra Valley Airport. Extending Runway 12-30 an additional 299 feet to 7,200 feet and strengthening the pavement to 75,000 pounds DWL will allow this runway to serve the needs of all ARC C-II design category aircraft that utilize the airport. Within the short term planning horizon, a GPS approach of one-half mile visibility minimums should be established for Runway 12. Additionally, implementation of this GPS approach will require the installation of a MALSR approach lighting system and new

	EXISTING	SHORT TERM NEED	LONG TERM NEED
RUNWAYS & TAXIWAYS			
	**Runway 3-21** 4,201' x 75' 12,500 lbs. SWL Partial-length Parallel Taxiway Three Entrance/Exit Taxiways **Runway 12-30** 6,901' x 100' 12,500 lbs. SWL Full-length Parallel Taxiway Four Entrance/Exit Taxiways -- -- -- -- --	**Runway 3-21** 4,700' x 75' Same Full-length Parallel Taxiway Additional Exit Taxiways **Runway 12-30** 7,200' x 100' 75,000 lbs. DWL Extend Full-length Parallel Taxiway Two High-Speed Exit Taxiways Additional Exit Taxiways -- -- -- -- --	**Runway 3-21** Same 30,000 lbs. DWL Same Same **Runway 12L-30R** Same Same Same Same Same **Runway 12R-30L** 4,700' x 75' 30,000 lbs. DWL Full-length Parallel Taxiway Minimum 2 Exit Taxiways
NAVIGATIONAL AIDS, AIRFIELD LIGHTING, AND MARKING			
	Rotating Beacon NDB [1] AWOS III **Runway 3-21** VASI-2 (Both) -- MIRL Visual Runway Markings Twy. Centerline/Edge Markings -- **Runway 12-30** PAPI-4 (Both) REIL (Both) MIRL Visual Runway Markings -- -- -- Twy. Centerline/Edge Markings -- --	Same Same Same **Runway 3-21** Papi-2 (Both) REIL (Both) Same Same Same -- **Runway 12-30** Same Same Same 1/2-mile GPS Approach (Rwy 12) MALSR (Rwy 12) Precision Rwy. Markings (Rwy 12) -- Same -- --	Same Phase out NDB Same **Runway 3-21** Same Same Same Same Same 1-mile GPS Approach (Both) **Runway 12L-30R** Same Same Same Same Same Same Same 1-mile GPS Approach (Rwy 30R) Same **Runway 12R-30L** NAVAIDS, Lighting & Marking (same as Runway 3-21)

[1] NDB currently in testing /certification stage.

AVRA VALLEY AIRPORT

Exhibit 3A
AIRFIELD REQUIREMENTS

precision runway markings. GPS approaches of one-mile visibility minimums should be considered for all remaining runway ends by the end of the long term planning period. For Runway 3-21, an extension of 499 feet to 4,700 feet will allow it to meet all ARC B-II aircraft requirements. Additionally, the proposed parallel runway to Runway 12-30 should be constructed to ARC B-II standards of 4,700 feet in length by 75 feet in width. Both Runway 3-21 and the new parallel runway should have a 30,000 pound DWL pavement strength rating. The visual approach lighting to Runway 3-21 should be upgraded from VASI-2 to PAPI-2. Similarly, match all lighting of the new runway with that of existing Runway 3-21. Pavement edge lighting is needed along all taxiway surfaces, both existing and proposed, at the airport.

LANDSIDE REQUIREMENTS

Landside facilities are those necessary for handling of aircraft and passengers while on the ground. These facilities provide the essential interface between the air and ground transportation modes. The capacities of the various components of each area were examined in relation to projected demand to identify future landside facility needs.

AIRCRAFT STORAGE FACILITIES

The space required for hangar facilities is dependent upon the number and type of aircraft expected to be based at the airport. Out of the current total of 206 based aircraft, 137 are hangared in T-hangars, another 26 under T-shade facilities, 11 at open tie-down locations with the remaining 32 aircraft either in conventional hangars or parked on the aircraft parking ramps located at various places on the airport. Varied weather conditions at Avra Valley Airport, ranging from extreme heat to intense "monsoon" thunderstorms, would suggest that the majority of aircraft owners prefer to hangar their aircraft over tying them down outside. It is therefore necessary to determine what percentages of these aircraft would utilize conventional-type hangars as opposed to individual T-hangars. A breakdown of the existing T-hangar and shade hangar facilities at the airport is presented in **Table 3F**.

Besides being less expensive to construct than conventional hangars, T-hangars provide aircraft owners with more privacy and allow for easier access to their aircraft. Shade hangars offer some protection from the weather yet are not as secure as enclosed T-hangars. The principal uses of conventional hangars at general aviation airports are for large aircraft storage, aircraft storage during maintenance, and for housing fixed based operator activities. Currently, approximately 67 percent of based aircraft at Avra Valley Airport are stored in T-hangar facilities, another 13 percent under T-shades, and 5 percent at tie-down positions while the percentage stored in conventional hangars fluctuates according to hangar usage activities. By the end of the long term planning horizon the number of based aircraft to be hangared is expected to be 365 or 80 percent of total based aircraft. Of this 365 aircraft, 320 will utilize T-hangar or shade hangar facilities while the remaining 45 would be housed in conventional hangars. As previously discussed, conventional hangar utilization varies according to hangar usage activities.

TABLE 3F
Existing Aircraft Hangar Facilities (Single and Twin-Engine Type Aircraft)

Description	Existing Positions	Length of Waiting List	Average Length of Wait
T-30 Hangar (37' to 39' Door)	72	84	4 to 6 Months
T-40 Hangar (44' to 46' Door)	20	5	6 to 8 Months
T-50 Hangar (50' Door)	10	6	4 to 6 Months
T-60 Hangar (60' Door)	10	4	12 to 18 Months
Sport Hangar (25' Door)	12	16	No Longer Renting (Phasing Out)
Shade Hangar	28	12	4 to 6 Months
Totals	152	127	

Table 3G estimates future hangar requirements for the airport. A planning standard of 1,200 square feet per based aircraft stored in T-hangars has been used to determine future T-hangar requirements. For planning, a standard of 2,500 square feet per based aircraft for large aircraft stored in conventional hangars has been adopted to determine future conventional hangar demands. Conventional hangar area was increased by 15 percent to account for future aircraft maintenance needs.

AIRCRAFT PARKING APRONS

A parking apron should be provided for at least the number of locally-based aircraft that are not stored in hangars, as well as transient aircraft. Currently, there are 94 tie-down spaces available on the main aircraft parking apron located north of the T-hangar and T-shade area. This apron is used by single and twin-engine GA aircraft, and is not presently divided into local and transient parking positions. According to TAC, Inc., they lease tie-down space to 11 local aircraft owners while the number of transient aircraft utilizing this tie-down apron averages approximately 4 daily. To bring this tie-down area up to its full usable capacity will require replacement of several missing or broken tie-down rings and chains. It is assumed that the majority of future based aircraft will be stored in an enclosed hangar, although a certain number of based aircraft will still tie-down outside. Future total apron area requirements were determined by applying a planning criterion of 800 square yards per transient aircraft parking position and 650 square yards for locally-based aircraft parking position (both include a factor for taxilanes).

TABLE 3G
Aircraft Storage Hangar Requirements

			Future Requirements		
	Currently Available	Current Requirements	Short Term	Intermediate Term	Long Term
Aircraft to be Hangared		180	218	269	365
T-Hangar/Shade Hangar Units or Positions	152	163	193	234	320
Conventional Hangar Positions	20	17	25	35	45
T-Hangar/Shade Hangar Area (s.f.)	143,000	195,600	231,600	280,800	384,000
Conventional Hangar Area (s.f.)	22,500	42,500	68,750	96,250	123,750
Total Hangar Area (s.f.)	165,500	238,100	300,350	377,050	507,750

Larger, transport-type aircraft use the Transport Apron area located east of the above-mentioned, main aircraft parking apron. Future apron size requirements to accommodate these larger aircraft were arrived at by using 2230 square yards per aircraft parking position. The results of these analysis are shown in **Table 3H**.

GENERAL AVIATION TERMINAL FACILITIES

General aviation terminal facilities serve several functions at an airport. This includes providing passenger waiting areas, a pilot's lounge and flight planning, restrooms, concessions, administrative and management offices, storage plus various other needs. The area required for these facilities is not necessarily limited to a single building, but also includes the space used by fixed base operators for similar functions and services.

At present, there is not a dedicated airport terminal facility at Avra Valley Airport; however, as noted in Chapter One, Tucson Aeroservice Center, Inc.'s office and administration building serves this function for the airport. Restrooms, passenger waiting area, pilot's room, flight planning, and concessions are just some of the services available in their facility. The completion of the 7,000 square foot (s.f.) expansion of TAC's existing 2,400 s.f. facility, as discussed in Chapter One, was put on hold due to fire suppression/supply requirements of the State Fire Marshall's office which is discussed in greater detail under the Public Utilities section later in this chapter.

The methodology used in estimating general aviation terminal facility needs are based on the number of airport users expected to utilize general aviation facilities during the design hour. Future space requirements were then based upon providing 75 square feet per

design hour itinerant passenger. **Table 3J** outlines these future requirements for general aviation terminal services at Avra Valley Airport throughout the planning period.

TABLE 3H
Apron Requirements

	Currently Available	Current Requirements	Future Requirements: Short Term	Future Requirements: Intermediate Term	Future Requirements: Long Term
General Aviation Aircraft Parking					
Transient Aircraft					
Positions	--	4	7	9	12
Apron Area (s.y.)	--	3,200	5,600	7,200	9,600
Local Aircraft					
Positions	--	11	18	21	28
Apron Area (s.y.)	--	7,150	11,700	13,650	18,200
Total Transient/Local G.A. Positions	94	15	25	30	40
Total Transient/Local G.A. Apron Area (s.y.)	24,850	10,350	17,300	20,850	27,800
Transport Aircraft Parking					
Transport Apron					
Positions	6 to 8	6	8	10	12
Apron Area (s.y.)	20,106	13,380	17,840	22,300	26,760
Total Combined G.A./Transport Apron Area (s.y.)	44,956	23,730	35,140	43,150	54,560

TABLE 3J
Terminal Requirements

	Currently Available	Current Requirement	Future Requirements: Short Term	Future Requirements: Intermediate Term	Future Requirements: Long Term
Design Hour Passengers		17	30	38	52
Building Space (s.f.)	2,400 [1]	1,275	2,250	2,850	3,900

[1] Tucson Aeroservice Inc. facilities

AVIATION SUPPORT FACILITIES

Certain facilities that do not logically fall under classifications of airfield, terminal building, or general aviation have been identified for inclusion within this Master Plan. Facility requirements, where applicable, have been identified for the following facilities:

- Airport Access
- Vehicle Parking
- Fuel Storage
- Airport Management Facility
- Aircraft Wash Rack
- Public Utilities
- Other Facilities

AIRPORT ACCESS

The main access to Avra Valley Airport is Avra Valley Road which runs along the southern boundary of the airport. The designated airport entrance road is located south of Tucson Aeroservice Center, Inc. and connects the airport to Avra Valley Road which connects to Interstate 10, approximately five miles east, and to Sanders Road which is about one-half mile west of the airport. Avra Valley Road also provides access to the eastern part of the Town of Marana which is located on the east side of I-10. Meanwhile, Sanders Road is oriented north-south, and from its intersection with Avra Valley Road to the north where it intersects I-10 is approximately five miles. Sandario Road, which intersects Avra Valley Road approximately 650 feet east of the airport entrance, provides southerly access to Avra Valley Airport. Additional airport access is available at the marked, unpaved access road which leads to Marana Skydiving on the west side of the airport as well other uncontrolled access points at various locations bordering airport property. Several tenants at Avra Valley Airport have expressed a concern regarding this uncontrolled access as it relates to airport security, possible solutions (security fencing including restricted access gating) to these concerns will be addressed in the next chapter, Chapter Four - Development Alternatives.

VEHICLE PARKING

Directly south of Tucson Aeroservice Center, Inc. is a paved, general parking area wit a capacity of approximately 80 to 90 automobiles. This lot also serves nonaviation customers frequenting the Sky Rider Restaurant. The security gate intended to separate the access road and parking lot from the terminal area was inoperable at the time the inventory process was completed, but currently is undergoing repair. Other automobile parking is available in various areas around buildings or inside T-hangars when aircraft are being flown.

Automobile parking requirements for future terminal area activities have been determined using a planning standard of 1.3 spaces per design hour passenger and 400 square feet for each parking position. Additionally, general aviation parking requirements are calculated under the assumption that 20 percent of the based aircraft will require automobile parking at any one time. The parking area required per space is the same that is used in terminal area activities parking requirements. **Table 3K** defines vehicle parking requirements for Avra Valley Airport. It must be remembered that the requirements reflected in the following table are based on terminal area activities only, as defined by design hour passengers and a percentage of based aircraft requiring

automobile parking. Other airport parking considerations such as employee, long-term and event parking will be addressed in the Development Alternatives chapter.

FUEL STORAGE

Avra Valley Airport's available fuel storage of 24,000 gallons consists of two 12,000 gallon aboveground storage tanks, one for 100LL fuel and the other for Jet-A fuel. As discussed in Chapter 1, the tanks and related dispensing equipment are owned and operated by Tucson Aeroservice Center, Inc. At the time of this report, TAC, Inc. indicated that they had begun the process of expanding their fuel storage capacity by an additional 12,000 gallons (Jet-A fuel, one tank). An airport's fuel storage requirements can vary based upon individual supplies and distributor policies, therefore, future fuel storage requirements for Avra Valley Airport will be dependent upon the independent distributor.

TABLE 3K
Vehicle Parking Requirements

	Currently Available	Current Requirement	Short Term	Intermediate Term	Long Term
Design Hour Passengers		17	30	38	52
Terminal Vehicle Spaces		22	39	49	68
Parking Area (s.f.)		8,800	15,600	19,760	27,040
General Aviation Spaces		41	58	68	88
Parking Area (s.f.)		16,400	23,200	27,280	35,200
Total Airport Parking Spaces	125±[1]	63	97	117	156
Total Airport Parking Area (s.f.)	40,000[1]	22,000	38,800	46,800	62,400

[1]The total number of airport parking spaces and airport parking area (square feet) shown is approximate and is for the parking lot south of Tucson Aeroservice Center, Inc. only.

AIRPORT MANAGEMENT FACILITY

As mentioned in Chapter 1, current airport management duties are performed by personnel at the Pima County Department of Transportation, Real Property Division offices located in downtown Tucson. Airport management is presently under the direction of an interim manager. This plan provides for the location of the permanent airport manager in a modular building on Avra Valley Airport property should the County so desire. The size and location of this structure will be examined in the following chapter.

AIRCRAFT WASH RACK

Presently, there is no designated aircraft wash rack facility at Avra Valley Airport. Any such future facility should be large enough to accommodate Aircraft Design Group I aircraft (49 foot wingspan). Additionally, an enclosed or covered structure should include a 20 foot tail height clearance. The location of the aircraft wash rack should be convenient to both aircraft storage and maintenance hangars as well as the aircraft parking aprons. Furthermore, this facility should comply with applicable waste water recovery/disposal procedures.

PUBLIC UTILITIES

As detailed in Chapter 1, sanitary sewer services are currently provided by ten (10) individual septic systems located throughout the Airport. With no existing or planned treatment facilities located in the immediate Airport vicinity, the implementation of sanitary sewer service in the form of a commercial grade septic system capable of serving the entire Airport is recommended. The design and capacity of this system should be flexible and large enough to handle existing requirements as well as future Airport expansion. The size and location of such a system or systems with regard to future airport development will be addressed in Chapter Four.

The State Fire Marshall's office has determined that the County must install a fire suppression or supply (i.e., fire hydrants) system at the Airport before proceeding with any further building construction. The exact design of this system is still to be decided, though recommendations as to its location will be discussed in Chapter 4. This fire suppression/supply system will be designed to serve both existing and future buildings. Components of this system may include a well, storage tanks, piping, booster pump station, and fire hydrants. In conjunction with the fire suppression/supply system, a potable water system consisting of a storage tank and two (2) booster pump stations will also be located and installed. Like the fire suppression/supply system, this potable water system will service both existing and future buildings.

All utilities, with regard to their capacity or limitation, necessary for the efficient operation of Avra Valley Airport will be considered when arriving at future airport master plan design alternatives.

OTHER FACILITIES

Currently, Avra Valley Airport has a minimal response capability with regard to aircraft emergencies. As noted in the inventory chapter there is an initial response truck on-site. The fire fighting equipment on this truck as well as available trained personnel is somewhat limited. Improvements to both the equipment and trained, qualified, response personnel must be considered to meet the needs of the type of aircraft expected to utilize the airport in the future.

CONCLUSIONS

A summary of the landside facility requirements is presented on **Exhibit 3B.** In order to meet future forecast demand, an increase in both T-hangar and conventional hangar space will be required during the planning period. Both the present number of tie-downs and available apron area for single

and twin-engine GA aircraft appears to be sufficient for future growth. Though currently adequate, increased utilization of the transport apron area may require a linear increase in apron area to accommodate larger numbers of transport-type aircraft using Avra Valley Airport. As itinerant use of the airport grows, additional general aviation terminal space or perhaps a separate terminal facility may be required. Enhanced airport security in the form of full airport perimeter fencing with restricted access gating must also be considered if the airport wishes to continue to attract business and corporate flyers as well as more on-airport commercial and industrial tenants. Vehicle parking availability at the airport as it relates to terminal area activity seems to be sufficient through the short term planning horizon but an increase in both parking capacity and types of parking available is warranted in the planning periods that follow. The installation of fire suppression system critical to new building construction is required. Improvements to airport utilities essential to continued development is needed, particularly the enhancement of sanitary sewage disposal, and an upgraded potable water storage and distribution system. Other future improvements to be considered include on-airport management presence and facilities, upgrades to emergency response personnel and equipment, and an aircraft wash rack facility.

SUMMARY

The purpose of this chapter has been to identify the facilities required to meet potential aviation demands projected for Avra Valley Airport through the planning horizon. The next step is to develop a direction for development to best meet these projected needs. The remainder of this master plan will focus on outlining this direction, its schedule, and costs.

	CURRENTLY AVAILABLE	SHORT TERM NEED	LONG TERM NEED
AIRCRAFT STORAGE HANGARS			
T-Hangar/Shade Hangar Positions	152	193	320
Conventional Hangar Positions	20	25	45
T-Hangar/Shade Hangar Area (s.f.)	143,000	231,600	384,000
Conventional Hangar Area (s.f.)	22,500	68,750	123,750
Total Hangar Area (s.f.)	165,500	300,350	507,750
APRON AREA			
GENERAL AVIATION PARKING			
Transient Aircraft Positions	--	7	12
Apron Area	--	5,600	9,600
Local Aircraft Positions	--	18	28
Apron Area	--	11,700	18,200
Total Transient/Local G.A. Positions	94	25	40
Total Transient/Local G.A. Apron Area (s.y.)	24,850	17,300	27,800
TRANSPORT PARKING			
Transport Aircraft Positions	6 to 8	8	12
Transport Apron Area (s.y.)	20,106	17,840	26,760
Total Apron Area (s.y.)	44,956	35,140	54,560
TERMINAL FACILITIES			
Building Space (s.f.)[1]	2,400	2,250	3,900
Terminal Vehicle Spaces	--	39	68
General Aviation Spaces	--	58	88
Total Parking Spaces	125	97	156
Total Parking Area (s.f.)	40,000	38,800	62,400

[1] Tucson Aeroservice Center, Inc.

AVRA VALLEY AIRPORT

Exhibit 3B
LANDSIDE REQUIREMENTS